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Ministry of Overseas Development

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THE PREPARATION OF COIR OR COCONUT FIBRE BY TRADITIONAL METHODS

Summary

The extraction of coir by traditional methods/ for mattress and bristle fibre as carried out in Ceylon is described and also the production of coir yarn in India.

Introduction

Coir fibre is obtained from the fruit of the coconut palm, *(Cocos nucifera L.)*. The fibrous tissue lies between the tough exocarp or outer covering and the hard shell or endocarp which surrounds the kernel.

There are three main types of coir fibre, the longest and finest is known as mat fibre and this is spun into yarn for making mats and ropes, a coarser fibre known as bristle fibre which is used for brushmaking, and a shorter staple fibre known as mattress fibre which is used for stuffing mattresses, upholstery, etc. For upholstery and rubberised coir mattresses it is advantageous to use curled fibre*. This is made by tightly twisting the moist fibre into a "rope". Curled fibre is exported in "ropes" which are untwisted by the user.

The chief supplier of bristle and mattress fibre is Ceylon. In India only mat fibre is prepared and this is spun into yarn or made into mats locally for export. There is a small industry in Ceylon for the production of yarn, and this industry is quite separate from the mattress and bristle production.

Production of Mattress and Bristle Fibre

COLLECTION OF THE FRUITS

For the production of the best grades of fibre the fruits should be gathered before they are quite ripe. If they have ripened the fibre becomes coarser and requires a longer retting period and is also usually darker in colour.

In Ceylon pluckings of the fruit are carried out every alternate month throughout the year, and the best crop is gathered in the May to June period. Men climb the trees to tap the nuts to ensure that they are ready for collecting. They may be broken off or cut off in bunches and dropped to the ground, or from ground level they can be gathered by using short knives attached to long bamboo poles.

/ See T.P.1. Report G29 for modern methods.

* A note on Rubberised Coir is available.

REMOVAL OF HUSKS

Husks are removed either at the coconut estates or at the fibre mills. Usually the millers buy the husks direct from the estates but if they are also interested in production of copra or desiccated coconut they purchase the complete fruit and remove the husks at their own premises. The husks are broken by striking them against a sharp stake or spike embedded firmly into the ground at a slight angle to the vertical. Alternatively a simple machine such as the Downs dehusking machine can be used.

RETTING

The next stage is the softening of the husks, to facilitate the extraction of the fibre. In Ceylon, retting is carried out in almost any area where stagnant water is available, eg ponds, at a river's edge, or in brackish water, but most commonly in specially dug pits. The average mill has two pits, each about 23m square and each taking up to 100,000 to 200,000 husks. Some of the more modern mills have their own well-built concrete retting tanks, but these are expensive and are therefore comparatively rare. The tanks are generally built in series, each unit measuring roughly 8.0m x 2.7m and being 1.8m in depth. They are built so that the water can be changed frequently and a cleaner, better quality fibre obtained. Sometimes larger concrete tanks about 23m square are used. The water may be changed by pumping it from one tank to another or by adding it from a reserve supply. In some factories retting time is reduced by soaking the husks for 30-40 hours in hot water, they are weighted down with boards and stirred frequently. Periodically the foul water is run off and replaced by clean water at the same temperature. Before soaking, the husks are crushed between fluted rollers to facilitate the penetration of water through the exocarp. At the large mills the total capacity of the tanks is said to be 200,000 crushed husks or 140,000 normal husks.

If the husks have been previously crushed, retting in tanks is complete in 3 to 7 days, otherwise they require 7 to 10 days. In pit retting where the husks are not crushed and the water is not changed the time taken is much longer, from 3 to 6 weeks, according to the position of the husks in the pit, those which are completely submerged require a shorter time than those on the surface. The retted husks are then removed from the pits or tanks by boys who wade into the water waist-high and throw out those husks considered ready for the drums. This can be made easier in the large pits or tanks by marking lanes or passageways with bamboo poles and clearing the lanes one at a time. The top husks which require further retting are thrown into the part of the pit just previously cleared.

EXTRACTION

After retting, the next stage is the extraction of the fibre from the husks. The extraction of fibre requires the breakdown and removal of both the connective tissue, or pith, between the fibres and also the outer exocarp. The process is sometimes called milling or decortication and is carried out using specially constructed machines called "drums". They are usually arranged in pairs one is called the "breaker" drum and the other the "cleaner" drum. The husk segments are first treated at the breaker drum. The drum consists of a wooden wheel about 0.9m in diameter having treads 0.3m wide and 15 cm long, into which have been bolted iron nails 3.8-5 cm apart. The main part of the wheel is enclosed in a wooden guard or casing, having an opening about 30 cm wide protected by a pair of iron bars. The nails are replaced every two months owing to wear and tear, since worn nails tend to split and damage the bristle fibre. The lower part of the casing of the wheel takes the form of a chute whereby the extracted fibre is delivered to the ground below and well clear of the wheels.

As the wheel revolves, first one end of the husk then the other is pressed between the bars. The nails tear away the short mattress fibre which passes down the chute, leaving the longer bristle fibre and pith in the hands of the operator. This bristle fibre is then laid aside for another operator to prepare further on the second or

Cleaning Drum which contains thinner nails placed 2.5 cm to 3.8 cm apart. Bristle fibre from three or four husks is subjected to the same procedure as before, pressing one end then the other against the rotating drum which has finer nails. In this way any remaining short fibre is combed out leaving only the long bristle fibre, which must be at least 8 inches (20 cm) long for the brush trade, in the operator's hands.

It is generally accepted that one pair of drums can handle 2,000 husks in a working day of 8 hours, producing 2 cwt (102 kg)* of bristle and 4 cwt mattress fibre. A small mill, therefore, with three or four pairs of drums should be able to produce 6 to 8 cwt bristle and 12 to 16 cwt mattress fibre per day.

Mattress Fibre

The two grades of fibre are treated separately. Mattress fibre is still wet. It has adhering to it much of the hard exocarp and pith which is separated by passing the material through a rotating horizontal wire mesh drum. Useless short fibre and dust fall through the mesh. The short fibres and pith are put through the sifter a second time, after which the waste is removed to a dust heap or hill. The cleaned mattress fibre is then dried by spreading it on the ground to a depth of about 45 cm. In good sunny weather drying will take about 8 days. During the course of drying, the fibre is turned over a few times to ensure thorough drying. Small boys usually do this by flicking the fibre with a forked stick. When completely dried, it is compressed in hand operated presses into small bales measuring 60 x 36 x 18 cm of approximately 10 lb (4.5 kg) called "ballots", and bound with coir twine.

The mattress fibre is classified at the Shippers' Store, where a few ballots are drawn for sampling purposes. Grading is done according to the fibre colour, length, resilience, and cleanliness generally, particular note being taken of the quantity of pith present. The best type of mattress fibre, "No 1" in the trade, has a golden colour. The next, "Fair Ordinary Brown" has duller colour and less life, while the lowest grade"No 2" is dark in colour. If necessary, after grading, the mattress fibre may be further cleaned by the shippers. In some instances it is teased before being packed for baling. The 153 kg bale varies in capacity from 0.28 cu.m to 0.34 cu.m.

Bristle Fibre

WASHING AND HACKLING

The bristle fibre is taken to special sheds where it is washed in clean fresh water by women and is carefully laid out to dry; when dried the women comb or "hackle" it by drawing it through steel combs or spikes 10-15 cm high, 2.5 cm apart, fixed vertically on a table. "Hackling" removes a further quantity of short-stapled fibre and bits of vegetable matter still adhering, thus giving a better quality of bristle fibre. This fibre is labelled "rough hackled" bristle fibre. At some mills, the bristle fibre is not hackled but after drying is made up into hanks when it is sold as "unhackled one tie" bristle fibre.

GRADING

At the Shippers' Stores, bristle fibre is inspected for its length, colour and stiffness. The commonest quality grades "1 tie" from the fact that the fibre is bound with a single cord of twisted fibre, receives no further treatment except for bleaching. The better quality is further dried and hackled by women, the second hackling being done

* 1 cwt = approximately 51 kg

more thoroughly and carefully. The hanks with the longest staple, about 12 inches (30 cm) long, of good colour, is known as "3 Tie" bristle, the best quality. The next grade of shorter fibre is bound with 2 cords and known as "2 Tie".

BLEACHING

Before shipping the coir fibre is usually bleached to give it a good even colour. Bleaching may be carried out in a specially sealed room having slatted floors under which there are tunnels. Pans of burning sulphur are placed in the tunnels and the fumes of sulphur dioxide bleach the fibre. After 24 hours the bristle fibre should have a uniform golden colour.

DYEING

There are two other processes which are sometimes done at the Shippers' Stores. These are dyeing and drafting. Fibre which it is intended to dye need not undergo bleaching. The fibre in a cage is first lowered into the bath of dye and afterwards allowed to drain. The coir is then carefully dried in special ovens.

DRAFTING

Drafting is really an extra hackling and grading according to fibre lengths. It is a process which calls for skill and experience. The resulting hanks of fibre are cut to a given length and the product is ready for immediate use for the brush trade. Although this treatment is expensive, it is said to be cheaper eventually for the manufacturers who normally have to carry out the process on their own premises.

BALING OF COIR FIBRE

Packing for shipment is usually in the form of 3 cwt (153 kg) bales. The hanks are piled in a steel box about 12 ft (3.7m) high and are hydraulically pressed to a height of about 2.5 ft (75 cm). The bales are then hooped and sewn up in jute hessian. If the fibre is required in "ballot" form ie a rectangular shaped package weighing about 10 lb (45 kg) and bound with coir string or hessian, then hanks are pressed into ballots in a hand-operated press.

Production of Mat or Yarn Fibre

There is a small export of coir yarn from Ceylon but the chief source is India, from where it is exported as yarn or in the form of manufactured coir goods eg mats, matting, carpets and ropes. In India only the one type of fibre is produced ie mat fibre which has a long fine staple, and the preparation is carried out on cottage industry lines while the weaving is done largely in factories.

The better quality of fibre produced in India is attributed to the following factors:-

1. The smaller coconuts give a finer fibre.

2. Plucking the fruits before they are ripe - much earlier than when producing bristle or mattress fibre.

3. The short interval between the plucking, husking, and removal to the retting areas.

4. The very much longer period for retting, which takes from 8-10 months.

5. The frequent removal during retting of foul stagnant water which is replaced at the change of tide by fresh sea water.

6. The clayey nature of the soil where the lagoons are situated.

PLUCKING

In Travancore, the 10 month-old fruits are collected every 45 days. The splitting of the husks is carried out immediately after plucking, and this is done in the same way as in Ceylon.

RETTING

The husks are usually retted for 8-10 months in the back-waters which are quiet and undisturbed and which have an ebb and flow so that there is a constant change of water. These back-waters may be connected with the sea by means of openings or lagoons, and the water then has certain saline properties to which a better quality and brighter colour of the fibre is attributed.

The husks may also be soaked in stagnant water such as in ponds or brooklets, in which case the time required for retting is much shorter than in back-water sections. The resulting fibre, however, is inferior and dull-looking. When the husks are sufficiently soft, they are removed, washed and squeezed in water in order to get rid of the mud and bad smell.

BEATING AND PICKING

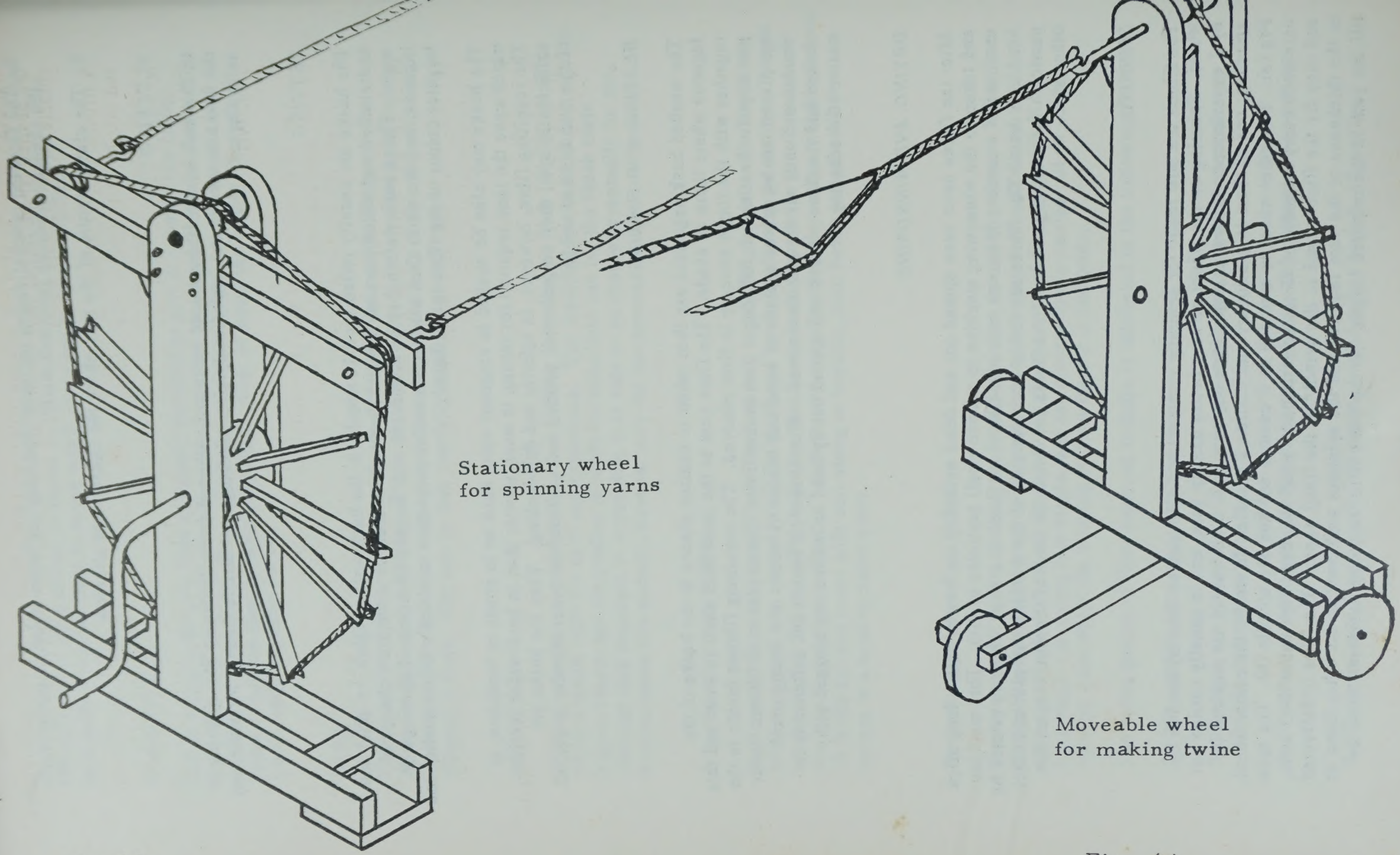
The washed husk segments are then taken to beating places in the banks of the lagoons where there is shade. The fibre next to the inner hard shell is short and this together with the tough exocarp is first removed. The remaining fibrous inside is the part kept for beating out the longer yarn or mat fibre. These pieces of fibrous tissue are placed one by one on a piece of wood and beaten by means of a strong round wooden rod until all the pith is removed. After it is well beaten and softened it is shaken and the fibre washed and spread out by hand to remove any clogged pithy matter still adhering.

DRYING AND WINNOWING

After the fibres have been spread out and dried well they are beaten with a long stick and taken to the winnowing machine to remove small particles of pith. This machine consists of a number of knives with saw-like teeth fixed to a shaft which is rotated by hand in a drum. The fibres are fed in from one side of the machine and pith and other particles fall on the ground and the fibres are thrown in front of the machine, on the other side.

SPINNING

The fibres are now ready for spinning into yarn and this may be done by hand or by wheel. Spinning on the wheel gives a better quality yarn, and is usually carried out by 2 experienced persons assisted by a boy or a girl. Two wheels are required for spinning; one of them is stationary and carries 2 spindles driven by the centre wheel. Fig (a). The other wheel is mounted on 3 castors and has one spindle (b). The spinners each carry a bundle of fibre, sometimes in small mat bags kept under their arms, and they fix the fibre strand to the spindle of the fixed wheel. The fibre is delivered to the thickness of the yarn required and the spinners walk back to the other frame or till the yarn is the required length. At the same time the young assistant turns the



Stationary wheel
for spinning yarns

Moveable wheel
for making twine

Fig. (a)

Fig. (b)

stationary wheel to give the yarn the necessary twist. When the strands have reached the desired length (about 18m) the ends are put together and fixed in the single spindle on the movable wheel.

A triangular block of wood grooved on the sides is introduced between the strands, and this helps to regulate the counter twist, prevents entanglements and binds the strands closely as the spindle on the moveable wheel is turned. The yarn thus twisted is made up into hanks, usually from 15m to 18m in length. Three persons working a set of wheels produce on average from 5 kg to 15 kg of yarn per day.

GRADING

The yarn is classified and graded according to the districts in which it is produced. The two main classes are Hard Twist or Machine Twist yarn and Soft Twist or Hand Twist yarn; the grade name comes from the locality where the yarn was produced.

Hard Twist Yarn. The main grades are Anjengo, Ashtamudy, Alapat, and Aratory and these are each sub-divided into numerous grades.

The Hard Twist yarn is used mainly for the manufacture of matting in factories but certain special kinds are used for rope making.

Soft Twist Yarn. These are classified as "Beach" and "Vycome" and both are again sub-divided into different numbers varying in price. Beach yarn is used for making mats and the finer variety in this class for the manufacture of matting. Similarly, "Vycome" yarn is used mainly for matting manufacture.